WEST

Generate Collection Print

L3: Entry 1 of 31 File: USPT Jan 7, 2003

DOCUMENT-IDENTIFIER: US 6502956 B1
TITLE: Light emitting diode lamp with individual LED lenses

Detailed Description Text (7):
The LED covers 32 are tailored to easily mount over each LED, which avoids the need to manufacture a large piece of lens consisting of many elements (which cannot be reused if the LED arrangement or desired light distribution pattern is changed). LED covers 32 are usable on LED displays of all sizes, are low cost, and offer great flexibility in that they are suitable for many different applications. LED covers 32 having different shaped lens portions 38 can be used on LEDs in the same LED lamp. Thus, some LED light outputs can be directed in one direction with one given spatial spread, while other LED light outputs from the same lamp can be directed in a different directions with differing spatial spreads. Moreover, the overall LED lamp output distribution can be modified by selectively replacing some of the lens covers 32 with other lens covers 32 having differently shaped lens portions 38. In fact, as described below, the individual LED covers 32 can be mounted in a manner so that they can be rotated to modify the LED lamp output distribution pattern.

Detailed Description Text (10):
While the above described embodiments of the LED covers 32 are illustrated as single piece elements, they could also be designed as multiple piece elements, where the lens portion 38 removably, semi-permanently or permanently attaches to the side portion 36. For example, FIGS. 8A-8D illustrate different shaped lens portions 38 that are removably, semi-permanently or permanently attached to the side portions 36. Thus, if the connection between the lens and side portions 38/36 is not permanent, then lens portion 38 can be replaced to modify the light distribution pattern without having to remove the side portion 36 (which could be permanently or semi-permanently mounted to the LED 14 or PCB 10).

Field of Search Class/SubClass (2):
362/244

# WEST

Generate Collection | Print

L3: Entry 1 of 31 File: USPT Jan 7, 2003

US-PAT-NO: 6502956
DOCUMENT-IDENTIFIER: US 6502956 B1

TITLE: Light emitting diode lamp with individual LED lenses

DATE-ISSUED: January 7, 2003

US-CL-CURRENT: 362/237; 362/245, 362/255, 362/800

APPL-NO: 09/ 277091 [PALM]
DATE FILED: March 25, 1999

WEST

Generate Collection Print

L3: Entry 4 of 31 File: USPT Sep 3, 2002

DOCUMENT-IDENTIFIER: US 6443594 B1
TITLE: One-piece lens arrays for collimating and focusing light and led light generators using same

Detailed Description Text (5):
The ability to optically optimize each individual lens 14a through 14e in the lens array 10 by providing them with their own specific lens prescription advantageously permits variable spacing of the LED sources 18 in an LED light generator 16. This is important for the following reason. For all designs, there is a tradeoff between the collimator's efficiency and its size. A smaller collimator is less efficient, but it improves the collection lens efficiency, since the focusing angle is smaller (larger collimators are more efficient but increase the focusing angle because they can be farther from the central axis of the light generator). Restated, there is a tradeoff between collimator efficiency and collection lens efficiency. In conventional light generator designs, the collimator efficiency (i.e., size of the collimator lens) decision can only be made once, globally, for all the LED sources. However, the collimator efficiency of each lens 14a through 14e of the lens array 10 of the present invention, can be specifically matched (a prescription which varies the "size" of the lens 14) for the position of its corresponding LED source 18. Since the collection efficiency of the collection lens 20 varies across its radius, matching can be accomplished by inversely varying the collimator efficiency of the of the lenses 14 of the array 10 according to how its corresponding LED source 18 is positioned relative to the collection lens 20. Hence, the use of the lens array 10 of the present invention can lead to higher total LED light generator efficiency. For example, the lenses 14a through 14e at the periphery 24a through 24e of the lens array 10 can have lens prescriptions that call for an increased exit aperture size. This would provide more collimation of light at the periphery of the lens array 10 thereby matching the lower collection efficiency at the periphery of the collection lens 20.

Issued US Original Classification (1):
362/244

Current US Original Classification (1):
362/244

Field of Search Class/SubClass (9):
362/242

Field of Search Class/SubClass (11):
362/244

US Reference US Original Classification (7):
362/244

US Reference US Original Classification (9):
362/244

US Reference Group (7):
5515253 19960500 Sjobom 362/244

US Reference Group (9):
5833355 19981100 You et al. 362/244

WEST

**End of Result Set**

Generate Collection | Print

L4: Entry 1 of 1 File: USPT Jun 12, 2001

DOCUMENT-IDENTIFIER: US 6244727 B1
TITLE: Optic lens cell and illuminated signage having a cell array

US PATENT NO. (1):
6244727

Brief Summary Text (13):
In a preferred embodiment of the present invention, the light sources are provided by LEDs with each LED axis and aperture axis being generally collinear. Also, the lens convex portions each have a central axis and the aperture is arranged in the lens so that each aperture central axis is generally collinear with each lens central axis. Each lens convex portion is generally convex about two axes and each aperture is cylindrical. The LEDs are mounted on a circuit board and wired together so they operate as one. A plurality of the cells may be combined together into an array and contained by a housing to form a sign or signal. An electric control may be provided with the housing or remotely located for timing and other control functions of the cells. Each cell is capable of being independently operated for forming various lighted patterns as may be desired for traffic lights, portable roadside lights, commercial signs and the like.

Detailed Description Text (3):
The LEDs 12 are mounted to at least one board 16 with an adhesive or by other mounting methods known to those skilled in the art and electrically connected to a power source (not shown) such as 120/240VAC, a battery, a photovoltaic cell, a generator, or the like. The board 16 is preferably provided by a conventional circuit board with electric conductors embedded in the surface of the board 16 so that each LED 12 may be electrically connected thereto and all the LEDs 12 on one board 16 may thus be electrically interconnected for coincidental operation. Optionally, the LEDs 12 and/or their wiring may extend through apertures defined in the board 16 for independent electrical connection to the power source so that each LED 12 may be individually operated. It should be noted that other arrangements may be suitably employed, such as electrically interconnecting the LEDs 12 by conventional wiring. In such an arrangement, the board 16 may be made of a plastic, metal, ceramic, composite, or other material known to those skilled in the art.

Detailed Description Text (19):
An electric control 56 is preferably provided within or attached to the housing 54. Optionally, the electric control 56 may be provided at a remote location such as a signalization box. The electric control 56 is electrically connected to the array 52 and capable of being electrically connected to a power source such as 120/240VAC at a utility transformer for fixed location traffic signal heads or a generator and/or batteries for portable road signs. Each cell 10 is preferably individually electrically connected to the control 56 so that each cell 10 may be operated individually within the array 52 to form lighted patterns including word messages, standardized traffic symbols, customized commercial displays, color schemes, combinations of these, and the like.

Detailed Description Text (27):
The sign 50 may then be installed in a variety of arrangements. For traffic and pedestrian signal heads, the sign 50 may be fixedly mounted at a traffic intersection on a signalization pole, a dedicated pole, or the like, or suspended from cables over the intersection. For portable road signs, the sign may be mounted on a towable trailer or the like with a battery or electrical connections for

connecting to a separate generator. For commercial and/or advertising signs, the sign 50 may be mounted onto a building structure, a pole, or the like and electrically connected to a power source of any type described above.

CLAIMS:

30. The illuminated sign of claim 29, wherein said electric control is capable of allowing each cell to be energized by said power source independently of said other cells to form lighted patterns.

WEST

**End of Result Set**

Generate Collection | Print

L5: Entry 1 of 1 File: USPT Jun 12, 2001

DOCUMENT-IDENTIFIER: US 6244727 B1
TITLE: Optic lens cell and illuminated signage having a cell array

US PATENT NO. (1):
6244727

Brief Summary Text (13):
In a preferred embodiment of the present invention, the light sources are provided by LEDs with each LED axis and aperture axis being generally collinear. Also, the lens convex portions each have a central axis and the aperture is arranged in the lens so that each aperture central axis is generally collinear with each lens central axis. Each lens convex portion is generally convex about two axes and each aperture is cylindrical. The LEDs are mounted on a circuit board and wired together so they operate as one. A plurality of the cells may be combined together into an array and contained by a housing to form a sign or signal. An electric control may be provided with the housing or remotely located for timing and other control functions of the cells. Each cell is capable of being independently operated for forming various lighted patterns as may be desired for traffic lights, portable roadside lights, commercial signs and the like.

Detailed Description Text (3):
The LEDs 12 are mounted to at least one board 16 with an adhesive or by other mounting methods known to those skilled in the art and electrically connected to a power source (not shown) such as 120/240VAC, a battery, a photovoltaic cell, a generator, or the like. The board 16 is preferably provided by a conventional circuit board with electric conductors embedded in the surface of the board 16 so that each LED 12 may be electrically connected thereto and all the LEDs 12 on one board 16 may thus be electrically interconnected for coincidental operation. Optionally, the LEDs 12 and/or their wiring may extend through apertures defined in the board 16 for independent electrical connection to the power source so that each LED 12 may be individually operated. It should be noted that other arrangements may be suitably employed, such as electrically interconnecting the LEDs 12 by conventional wiring. In such an arrangement, the board 16 may be made of a plastic, metal, ceramic, composite, or other material known to those skilled in the art.

Detailed Description Text (4):
At least one lens 18 is provided in each cell 10, the lens 18 preferably molded from a polycarbonate or acrylic material. Optionally, the lens 18 may be made of a thermoplastic resin or other material and fabricated by other methods known to those skilled in the art. The lens 18 may be generally transparent or have a tint or other light filter for producing a visible color as may be desired in a given application. The lens 18 and board 16 are preferably oriented in a generally parallel and spaced apart arrangement. The lens 18 is preferably rigidly attached to the board by a mounting member 19 such as a pin, rod, bracket, block, unitary arm extending from the lens 18, or other mounting mechanism known to those skilled in the art and selected to generally prevent movement of the lens 18 relative to the board 16 and to not interfere with light from the LEDs 12. The board 16 and lens 18 are preferably generally rectangular so that the resulting cell 10 has a generally rectangular shape. Optionally, the cell 10 may have a triangular, hexagonal, octagonal, other regular or irregular shape known to those skilled in the art.

Detailed Description Text (19):
An electric control 56 is preferably provided within or attached to the housing 54.

Optionally, the electric control 56 may be provided at a remote location such as a signalization box. The electric control 56 is electrically connected to the array 52 and capable of being electrically connected to a power source such as 120/240VAC at a utility transformer for fixed location traffic signal heads or a generator and/or batteries for portable road signs. Each cell 10 is preferably individually electrically connected to the control 56 so that each cell 10 may be operated individually within the array 52 to form lighted patterns including word messages, standardized traffic symbols, customized commercial displays, color schemes, combinations of these, and the like.

Detailed Description Text (26):
For construction and installation of the present invention, the cells 10 are combined into the array 52, electrically connected to the electric control 56, and enclosed within the housing 54 to form an illuminating sign or signal 50. As described hereinabove, all the components are either commercially available or are capable of being easily manufactured from readily available materials. The number, size, shape, and lens tint of the cells 10 may be selected for any desired application. The cells 10 for a particular array 52 are preferably generally uniform in shape and size and may be easily combined into an array 52 to form an illuminated sign 50 for any of a wide variety of lighting applications such as those described herein.

Detailed Description Text (27):
The sign 50 may then be installed in a variety of arrangements. For traffic and pedestrian signal heads, the sign 50 may be fixedly mounted at a traffic intersection on a signalization pole, a dedicated pole, or the like, or suspended from cables over the intersection. For portable road signs, the sign may be mounted on a towable trailer or the like with a battery or electrical connections for connecting to a separate generator. For commercial and/or advertising signs, the sign 50 may be mounted onto a building structure, a pole, or the like and electrically connected to a power source of any type described above.

CLAIMS:

30. The illuminated sign of claim 29, wherein said electric control is capable of allowing each cell to be energized by said power source independently of said other cells to form lighted patterns.

WEST

End of Result Set

Generate Collection Print

L9: Entry 1 of 1 File: USPT Mar 19, 2002

DOCUMENT-IDENTIFIER: US 6357904 B1
TITLE: Linear illumination device

US PATENT NO. (1):
6357904

Detailed Description Text (9):
The metal rear electrode 3, which is common for the organic EL elements 32 and 33, is electrically separated from the transparent electrodes 321 and 331. In FIG. 4, a space is provided between the organic EL elements 32 and 33 and spaces are provided between the side faces of the organic EL elements and the metal rear electrode 3, respectively. However, these spaces may be filled with a suitable insulating material.

Detailed Description Text (13):
FIG. 5 shows a linear illumination device for a contact type color image sensor, according to a second embodiment of the present invention. The linear illumination device shown in FIG. 5 employs two LED's as red and green color light emitters and an organic EL element as a blue color light emitter. In FIG. 5, the LED 21 capable of emitting red color light and an LED 22 capable of emitting green color light, which can be independently driven each other, are juxtaposed on one of end faces of an optical waveguide member 11. An organic EL element 33 capable of emitting blue color light is formed on substantially a whole upper surface of the optical waveguide member 11. An output light is emitted from a lower surface of the optical waveguide member 11 in a direction shown by an arrow 45.

WEST

Generate Collection | Print

L10: Entry 1 of 18 File: USPT Sep 3, 2002

DOCUMENT-IDENTIFIER: US 6443594 B1
TITLE: One-piece lens arrays for collimating and focusing light and led light generators using same

Abstract Text (1):
A lens array for a lamp directs light to a light conduit such as an optical fiber or light pipe for guiding light to a remote location. An array of LED serve as light sources. The lens array includes an integrally formed member having a number of collimator lenses positioned in the lens array so that each lens can operate as a collimator for a corresponding LED to produce a respective collimated beam of light. The lenses have optical properties that are optimized according to where their corresponding LED are positioned in the LED array, so that the lens array is provided with lens prescriptions that produce refraction of the collimated beams of light toward an entrance aperture of the light conduit.

Brief Summary Text (6):
Present LED light generator designs collect light from an array of separate LED sources, and focus the light at a target, such as the entrance aperture of an optical fiber. A critical aspect in most of these designs is the collimation and focusing of the separate LED sources in order to create a useable light beam.

Brief Summary Text (7):
Many LED light generator designs employ a plurality of separate and distinct primary optical elements (collimators) each of which efficiently captures the widely divergent light generated by a respective one of the LED sources. For practical reasons, the collimators are identical, and thus have parallel optic axes which produce collimated light beams which are parallel to one another. A second lens (collection lens) focuses the parallel collimated light beams at the desired target. The second lens must have relatively high-angle refraction to focus the light beams generated by the LED sources at the periphery of the array.

Brief Summary Text (8):
The use of a separate and distinct collimator for each LED source of the array undesirably increases the size, complexity and cost of the light generator design. This is because the collimators must be individually mounted and aligned using bulky mounting hardware and spacers that require expensive handling and alignment steps during assembly.

Brief Summary Text (11):
In one aspect of the invention, a lens array for a lamp directs light to a light conduit such as an optical fiber or light pipe for guiding light to a remote location. An array of LED serve as light sources. The lens array includes an integrally formed member having a number of collimator lenses positioned in the lens array so that each lens can operate as a collimator for a corresponding LED to produce a respective collimated beam of light. The lenses have optical properties that are optimized according to where their corresponding LED are positioned in the LED array, so that the lens array is provided with lens prescriptions that produce refraction of the collimated beams of light toward an entrance aperture of the light conduit.

Detailed Description Text (3):
FIG. 1 is a diagrammatic view showing a lens array 10 according to a first embodiment of the invention as used in a typical light emitting diode (LED) light generator 16 comprises of an array 17 of LED sources 18a through 18e. The lens array 10 integrates a plurality of collimator lenses 14a through 14e into a single

unitarily formed member 12 which can be inexpensively manufactured from plastic using known conventional optical plastic molding methods. The lenses 14a through 14e are positioned in the array 10 in a predetermined manner so that each LED source 18a through 18e has its own collimator. Each lens 14a through 14e this array 10 is optically optimized according to where its corresponding LED source 18a through 18e is positioned in the LED array 17. A planar collection lens 20 such as a Fresnel lens, is provided after the lens array 10 for focusing the light beams Ba through Be at a desired target 22 such as the entrance apertures of a light conduit such as an optical fiber or light pipe of a signage or illumination system. The collection lens 20 has a lens prescription that is selected to permit it to operate effectively with the optically optimized lenses 14a through 14e of the lens array 10.

Detailed Description Text (4):
As stated earlier, each lens 14a through 14e of the array 10 is optically optimized for the positioning of its corresponding LED source 18 in the LED array 17. For example, the lenses 14a through 14a located at the periphery 24a and 24e of the lens array 10 which collimate the LED sources 18a through 18e located at the periphery 26 of the LED array 17 is provided with their own specific lens prescriptions. Such a lens prescription can define a refractive surface 28a through 28e that enables the lens 14a through 14e to refract or "steer" the collimated beam Ba through Be of light partially toward the selected target 22. Because the lenses 14a through 14e are an integral molded one-piece member, virtually no additional manufacturing costs will be incurred as the individual lens prescriptions can be easily provided in the plastic molding tooling. Accordingly, the inventive lens array 10 permits the use of a variety of LED packages, size requirements, total-lumen requirements, etc. The data provided further on shows the results of a simplified calculation that illustrates this principle.

Detailed Description Text (5):
The ability to optically optimize each individual lens 14a through 14e in the lens array 10 by providing them with their own specific lens prescription advantageously permits variable spacing of the LED sources 18 in an LED light generator 16. This is important for the following reason. For all designs, there is a tradeoff between the collimator's efficiency and its size. A smaller collimator is less efficient, but it improves the collection lens efficiency, since the focusing angle is smaller (larger collimators are more efficient but increase the focusing angle because they can be farther from the central axis of the light generator). Restated, there is a tradeoff between collimator efficiency and collection lens efficiency. In conventional light generator designs, the collimator efficiency (i.e., size of the collimator lens) decision can only be made once, globally, for all the LED sources. However, the collimator efficiency of each lens 14a through 14e of the lens array 10 of the present invention, can be specifically matched (a prescription which varies the "size" of the lens 14) for the position of its corresponding LED source 18. Since the collection efficiency of the collection lens 20 varies across its radius, matching can be accomplished by inversely varying the collimator efficiency of the of the lenses 14 of the array 10 according to how its corresponding LED source 18 is positioned relative to the collection lens 20. Hence, the use of the lens array 10 of the present invention can lead to higher total LED light generator efficiency. For example, the lenses 14a through 14e at the periphery 24a through 24e of the lens array 10 can have lens prescriptions that call for an increased exit aperture size. This would provide more collimation of light at the periphery of the lens array 10 thereby matching the lower collection efficiency at the periphery of the collection lens 20.

Detailed Description Text (6):
Other advantages are realized with the lens array 10 of the invention. For instance, the lens array 10 also reduces the light generator's 16 manufacturing cost because it requires substantially less handling and alignment during assembly as compared to conventional separate collimator lens elements. Additionally, the inventive lens array 10 permits a more compact light generator design with substantially the same optical function as larger conventional designs, because the mounting lips and spacers associated with conventional separate collimator lens elements are not needed.

Detailed Description Text (7):
The collection lens 20 used with the lens arrays 10 that have lenses with "beam steering" lens prescriptions require modification to operate effectively with the lens array 10. The lens array 10 depicted in FIG. 1 provides only a small amount beam steering thus the curvature of the collection lens 20 can be modified from that

of a simple spherical lens in order to more efficiently refract the "steered" beams B of the light from the lens array 10.

Detailed Description Text (9):
As should now be apparent, the lens array 10 of the invention has two separate advantages. The first is cost. The single unitarily formed member part is less expensive to manufacture than the many parts that it replaces in conventional light generator designs. The second advantage is performance. The integration permits a more complex optical design at virtually no additional manufacturing cost, leading to improved light collection as the lens array 10 collimates and also partially steers the light towards the light generator exit aperture and the collection lens then completes the task of focusing. By splitting the refraction angle burden between two elements, the total efficiency is improved.

Current US Original Classification (1):
362/244

Current US Cross Reference Classification (1):
362/236

Current US Cross Reference Classification (2):
362/237

Current US Cross Reference Classification (3):
362/241

CLAIMS:

1. A lens array for a lamp using a light conduit such as an optical fiber or light pipe for guiding light to a remote location, and an array of LED as light sources, the lens array comprising an integrally formed member having a plurality of collimator lenses, the lenses positioned in the lens array so that each lens can operate as a collimator for a corresponding LED to produce a respective collimated beam of light, the lenses having optical properties which are optimized according to where their corresponding LED are positioned in the LED array, wherein the lens array is provided with lens prescriptions that produce refraction of the collimated beams of light toward an entrance aperture of the light conduit.

2. The lens array of claim 1, wherein each of the lens prescriptions defines a refractive surface thait refracts an associated collimated beam of light toward the entrance aperture of the light conduit.

3. The lens array of claim 1, wherein the lens prescription also provides the one or more lenses with their own selected collimating characteristics.

5. The lens array of claim 4, wherein the lens prescription also provides the one or more lenses with their own selected collimating characteristics.

6. The lens array of claim 1, wherein one or more of the lenses of the lens array are provided with lens prescriptions which provide the one or more lenses with their own selected collimating characteristics.

12. The light generator of claim 8, wherein one or more of the lenses of the lens array are provided with lens prescriptions which provide the one or more lenses with their own selected collimating characteristics.

14. The light generator of claim 8, wherein one or more of the lenses of the lens array are provided with lens prescriptions that produce refraction of the collimated light beams toward the entrance aperture of the light conduit.

15. The light generator of claim 14, wherein each of the lens prescriptions defines a refractive surface that refracts an associated collimated beam of light toward the entrance aperture of the light conduit.

19. The light generator of claim 18, wherein the lens prescription also provides the one or more lenses with their own selected collimating characteristics.

20. The light generator of claim 14, wherein the lens prescription also provides the one or more lenses with their own selected collimating characteristics.